

First record of *Hoplobatrachus litoralis* Hasan, Kuramoto, Islam, Alam, Khan & Sumida, 2012 (Anura, Dicroglossidae) from China

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Abstract

We report the first record of *Hoplobatrachus litoralis* Hasan, Kuramoto, Islam, Alam, Khan & Sumida, 2012 from China based on seven specimens from Baoshan City, western Yunnan. Morphologically, the specimens from China mostly agree with the original description of *H. litoralis* and phylogenetically show a small genetic distance (1.7%) in the 16S rRNA gene with the specimens (including one paratype) of *H. litoralis* from its type locality in Bangladesh. Our work increased the species number of the genus *Hoplobatrachus* Peters, 1863 in China to two. This record is the easternmost distribution of this species at present. Furthermore, we found that the species *H. salween* Thongproh, Chunskul, Sringurngam, Waiprom, Makchai, Cota, Duengkae, Duangjai, Hasan, Chuaynkern & Chuaynkern, 2022 recently described from north-western Thailand is morphologically and genetically very similar to *H. litoralis* and, therefore, we discuss the validity of *H. salween* as a separate species.

Key Words

16S rRNA, Baoshan, distribution, Longling, western Yunnan

Introduction

For a long time, it was considered that only one species of the genus *Hoplobatrachus* Peters, 1863 was distributed in China, namely, *H. chinensis* (Osbeck, 1765) and it was thought to be widely distributed in southern China (Fei et al. 2009, 2012; AmphibiaChina 2022; Frost 2022). Although this species has a wide distribution range, it is regarded as a legally protected species in China due to the rapid decline of its population size (Jiang and Xie 2021).

Hoplobatrachus litoralis Hasan, Kuramoto, Islam, Alam, Khan & Sumida, 2012 is a species originally described from Bangladesh (Hasan et al. 2012). Subsequently, Mulcahy et al. (2018) and Zug (2022)

extended the range of this species into Myanmar, while Purkayastha and Besak (2018), Mondal et al. (2018), Bohra et al. (2019), Kundu et al. (2020) and Lalrem-sanga et al. (2022) recorded this species in India and Wangyal et al. (2020) reported this species from Bhutan. *Hoplobatrachus litoralis* inhabits vegetated, marshy ditches or ponds. It is characterised by large body size, a broad black band from anterior corner of eye through the nostrils to anterior edge of upper jaw, a band along the lateral margin of upper jaw, a distinct black margin in the inner side of the upper arm, a black inner metatarsal tubercle and inter-orbital distance that is much narrower than eyelid width and inter-nostril distance (Hasan et al. 2012).

While studying the *Hoplobatrachus* specimen collection of Kunming Natural History Museum of Zoology, Kunming Institute of Zoology, Chinese Academy of Sciences (KIZ), we discovered a jar with seven specimens determined as *H. chinensis* and collected from Longling, Baoshan, Yunnan. After detailed examination of these specimens, we found that they more closely resemble *H. litoralis* rather than *H. chinensis*. Since molecular analysis conducted in this study also indicated that these specimens belong to *H. litoralis*, we report this new record for China in detail.

Materials and methods

Genomic DNA was extracted from liver tissues using the standard phenol-chloroform extraction protocol (Sambrook et al. 1989). A partial fragment of the mitochondrial 16S rRNA was amplified for all samples via the polymerase chain reaction (PCR) using the primers L2188 (Matsui et al. 2006): 5'-AAAGTGGGCCTAAAAG-CAGCCA-3' and 16H1 (Hedges 1994): 5'-CTCCG-GTCTGAAGTCAGATCACGTAGG-3'. The products were purified and sequenced by Tsingke Biotechnology (Beijing) Co., Ltd. All new sequences were deposited in GenBank. *Euphlyctis cyanophlyctis* (Schneider, 1799) and *E. hexadactyla* (Lesson, 1834) were chosen as outgroups according to Hasan et al. (2012). Homologous and outgroup sequences were obtained from GenBank (Table 1). The technical computation methods for the best substitution model selection, Bayesian Inference and Maximum Likelihood phylogenetic analyses were the same as those in Liu et al. (2020).

Measurements were taken with a digital caliper to the nearest 0.1 mm. Morphological terminology follows Hasan et al. (2012). Abbreviations of the morphometric traits are as follows: snout-vent length (SVL), head length (HL), head width (HW), snout to nostril distance (S-N), inter-nostril distance (N-N), nostril to eye distance (N-E), horizontal eye diameter (ED), inter-orbital distance between inner borders of upper eyelids (E-E), eyelid width (ELW), horizontal tympanum diameter (TD), forelimb length (FLL), forearm and hand length (FHL), forearm width (FAW), hand length (HAL), length of 1st to 4th finger (F1-F4), hind-limb length (HLL), femur length (FEL), tibia length (TIL), tarsus and foot length (TFL), foot length (FOL), length of 1st to 5th toe (T1-T5) and inner metatarsal tubercle length (IMT).

Results

Bayesian Inference and Maximum Likelihood analyses showed consistent topology. The sequences of the specimens from Baoshan, western Yunnan, China, clustered with the sequences of the specimens from Mae Hong Son, Thailand and Bago and Yangon, Myanmar and all together clustered with the sequences of the specimens

of *Hoplobatrachus litoralis* from Bangladesh (including one paratype IABHU 3974) and India (Fig. 1). The average genetic distance (uncorrected p-distance) between the specimens from China and the specimens of *H. litoralis* from its type locality in Bangladesh (including one paratype IABHU 3974) is 1.7% and the average genetic distance (uncorrected p-distance) between the specimens from China and the specimen of *H. litoralis* from India is 1.4% (Table 2). Morphological measurements of the specimens from China are presented in Table 3. As the specimens from China are not adults, we only compared the body ratios of these specimens (Table 4) with the relevant data from the original description of *H. litoralis* by Hasan et al. (2012). The specimens from China have relatively greater snout to nostril distances (S-N/SVL 0.080–0.094 vs. 0.044–0.076), relatively greater eye diameters (ED/SVL 0.118–0.133 vs. 0.063–0.107) and relatively greater lengths of fourth toe (T4/SVL 0.397–0.438 vs. 0.277–0.368); apart from these, all other ratios of the specimens from China overlap with the relevant data from the original description of *H. litoralis*. In addition, the colour patterns on these specimens from China agree well with the original description of *H. litoralis*.

Taxonomic account

Hoplobatrachus litoralis Hasan, Kuramoto, Islam, Alam, Khan & Sumida, 2012

Figs 2, 3, 4A, B

Specimens examined. KIZ 034006–KIZ 034012, seven subadults, all collected on 21 August 2013 from Manguanhe Village, Mengnuo Town, Longling County, Baoshan City, Yunnan Province, China (24°20'41"N, 99°1'11"E; elevation 750 m).

Morphological description. Head longer than wide (HL/HW 1.13–1.23), obtusely pointed. Canthus rostralis blunt. Loreal region concave. Nostril slightly nearer to tip of snout than to eye (S-N/N-E 0.78–0.97). Tympanum smaller than eye (TD/ED 0.51–0.59). Inter-orbital space much narrower than eyelid width and inter-nostril space (E-E/ELW 0.48–0.70, E-E/N-N 0.50–0.78).

Fingertips blunt without disc, no webbing on fingers. Finger length $F3 > F1 > F2 > F4$ or $F3 > F1 > F4 > F2$. Subarticular, thenar and palmar tubercles distinct.

Hind-limb moderately long (HLL/SVL 1.53–1.71). Femur length almost equal to tibia length (FEL/TIL 0.92–1.01). Toe tips blunt, slightly rounded. Toe length $T4 > T5 > T3 > T2 > T1$ or $T4 > T3 > T5 > T2 > T1$. Webbing reaching the base of toe tip, incurved between toe tips. Subarticular tubercles moderate, inner metatarsal tubercle distinct, no outer metatarsal tubercle.

Many distinct thin longitudinal ridges on dorsum. Indistinct small round warts over dorsal and lateral body. Dorsal limbs smooth. Supratympanic fold from behind eye to posterior margin of tympanum. Weak tarsal ridge extending from proximal end of inner metatarsal tubercle to heel.

Table 1. Sequences used for phylogenetic analysis in this study.

Taxon	Voucher no.	Locality	GenBank no.
<i>Hoplobatrachus chinensis</i>	SYS a006157	Guangdong, China	ON615100
<i>Hoplobatrachus chinensis</i>	SCUM0437941	Yunnan, China	DQ458251
<i>Hoplobatrachus chinensis</i>	MVZ 224079	Tam Dao, Vinh Phuc, Vietnam	EU979844
<i>Hoplobatrachus chinensis</i>	ZFMK TZ55	Ky Thuong, Ha Tinh, Vietnam	AF285208
<i>Hoplobatrachus chinensis</i>	2007.6265	Huu Lien, Lang Son, Vietnam	KR827770
<i>Hoplobatrachus chinensis</i>	ZFMK TZ301	Ky Thuong, Ha Tinh, Vietnam	AY014372
<i>Hoplobatrachus chinensis</i>	VUB 0684	Vietnam	AY322289
<i>Hoplobatrachus chinensis</i>	2003.8636	Phongsaly, Laos	KR827767
<i>Hoplobatrachus chinensis</i>	0033Y	Uttaradit, Thailand	KR827766
<i>Hoplobatrachus crassus</i>	BAUFBG 20865	Khulna, Bangladesh	AB272595
<i>Hoplobatrachus crassus</i>	IABHU 3859	Chittagong, Bangladesh	AB543601
<i>Hoplobatrachus crassus</i>	IABHU 3973	Cox's Bazar, Bangladesh	AB671184
<i>Hoplobatrachus crassus</i>	MNHNF 20698	Assam, India	AB290413
<i>Hoplobatrachus crassus</i>	CDZMTU282	Nepal	MT983032
<i>Hoplobatrachus crassus</i>	CDZMTU283	Nepal	MT983033
<i>Hoplobatrachus litoralis</i>	IABHU 3975	Cox's Bazar, Bangladesh	AB671173
<i>Hoplobatrachus litoralis</i>	IABHU 3974	Cox's Bazar, Bangladesh	AB671174
<i>Hoplobatrachus litoralis</i>	IABHU 3985	Cox's Bazar, Bangladesh	AB671175
<i>Hoplobatrachus litoralis</i>	IABHU 3982	Cox's Bazar, Bangladesh	AB671176
<i>Hoplobatrachus litoralis</i>	IABHU 3977	Cox's Bazar, Bangladesh	AB671177
<i>Hoplobatrachus litoralis</i>	IABHU 3983	Cox's Bazar, Bangladesh	AB671178
<i>Hoplobatrachus litoralis</i>	IABHU 3976	Cox's Bazar, Bangladesh	AB671179
<i>Hoplobatrachus litoralis</i>	IABHU 3988	Cox's Bazar, Bangladesh	AB671180
<i>Hoplobatrachus litoralis</i>	IABHU 3978	Cox's Bazar, Bangladesh	AB671181
<i>Hoplobatrachus litoralis</i>	MZMU-1777	Mizoram, India	OM501581
<i>Hoplobatrachus litoralis</i>	USNM 587325	Yangon, Myanmar	MG935819
<i>Hoplobatrachus litoralis</i>	USNM 587404	Yangon, Myanmar	MG935820
<i>Hoplobatrachus litoralis</i>	MBM-USNMFS 35607	Bago, Myanmar	MG935818
<i>Hoplobatrachus litoralis</i>	KKUC 01173/THNHM 26829	Mae Hong Son, Thailand	MW244089
<i>Hoplobatrachus litoralis</i>	THNHM 26827	Mae Hong Son, Thailand	MW244088
<i>Hoplobatrachus litoralis</i>	THNHM 26828	Mae Hong Son, Thailand	MW244087
<i>Hoplobatrachus litoralis</i>	KIZ 034006	Baoshan, Yunnan, China	OQ535767
<i>Hoplobatrachus litoralis</i>	KIZ 034007	Baoshan, Yunnan, China	OQ535768
<i>Hoplobatrachus litoralis</i>	KIZ 034008	Baoshan, Yunnan, China	OQ535769
<i>Hoplobatrachus litoralis</i>	KIZ 034009	Baoshan, Yunnan, China	OQ535770
<i>Hoplobatrachus litoralis</i>	KIZ 034010	Baoshan, Yunnan, China	OQ535771
<i>Hoplobatrachus litoralis</i>	KIZ 034011	Baoshan, Yunnan, China	OQ535772
<i>Hoplobatrachus litoralis</i>	KIZ 034012	Baoshan, Yunnan, China	OQ535773
<i>Hoplobatrachus occipitalis</i>	MVZ235754	Nouakchott, Mauritania	EU979845
<i>Hoplobatrachus occipitalis</i>	MVZ234146	Mwanza, Tanzania	EU979846
<i>Hoplobatrachus occipitalis</i>	ZFMK 65186	Uganda	AY014374
<i>Hoplobatrachus occipitalis</i>	ZFMK 23WB01	Mauritania	AY014373
<i>Hoplobatrachus occipitalis</i>	FMNH 257224	Ivory Coast	AF261263
<i>Hoplobatrachus occipitalis</i>	IABHU 20699	Africa	LC640619
<i>Hoplobatrachus tigerinus</i>	IABHU 3902	Mymensingh, Bangladesh	AB530500
<i>Hoplobatrachus tigerinus</i>	IABHU 4000	Mymensingh, Bangladesh	AB671182
<i>Hoplobatrachus tigerinus</i>	IABHU 4001	Mymensingh, Bangladesh	AB671183
<i>Hoplobatrachus tigerinus</i>	CDZMTU285	Nepal	MT983035
<i>Hoplobatrachus tigerinus</i>	CDZMTU286	Nepal	MT983036
<i>Euphlyctis cyanophlyctis</i>	MNHN 2000.650	Cochin, India	AY014366
<i>Euphlyctis hexadactyla</i>	EH98	India	GU136102

Colouration. In preservative, dorsum light grey to dark grey, a whitish mid-dorsal stripe from tip of snout to vent. Many large black spots on dorsal and lateral body. Large oval black spots on dorsal surface of limbs. A distinct black stripe from tip of snout through nostril to anterior corner of eye on each side. A short black stripe below eye each side. A gradually widening black stripe along supratympanic fold on each side. Upper lips brown, lower lips white with some black spots. A light thick stripe from posterior corner of eye to groin on each side. Rear side of thigh heavily mottled. Ventral side white, except for some black spots along the edge of lower jaw to the base of forelimb.

Recommended Chinese name. 孟加拉虎纹蛙 (Pinyin: mèng jiā lā hǔ wén wā).

Comparison between *Hoplobatrachus litoralis* and *H. chinensis*. *Hoplobatrachus litoralis* differs from *H. chinensis* by snout to anterior eye stripe present in *H. litoralis* vs. absent in *H. chinensis*, supralabial stripe present in *H. litoralis* vs. absent in *H. chinensis*, mid-dorsal stripe present in *H. litoralis* vs. absent in *H. chinensis*, distinct large round black spots on dorsum of *H. litoralis* vs. indistinct irregular small black spots on dorsum of *H. chinensis*, light stripe from posterior corner of eye to groin present in *H. litoralis* vs. absent

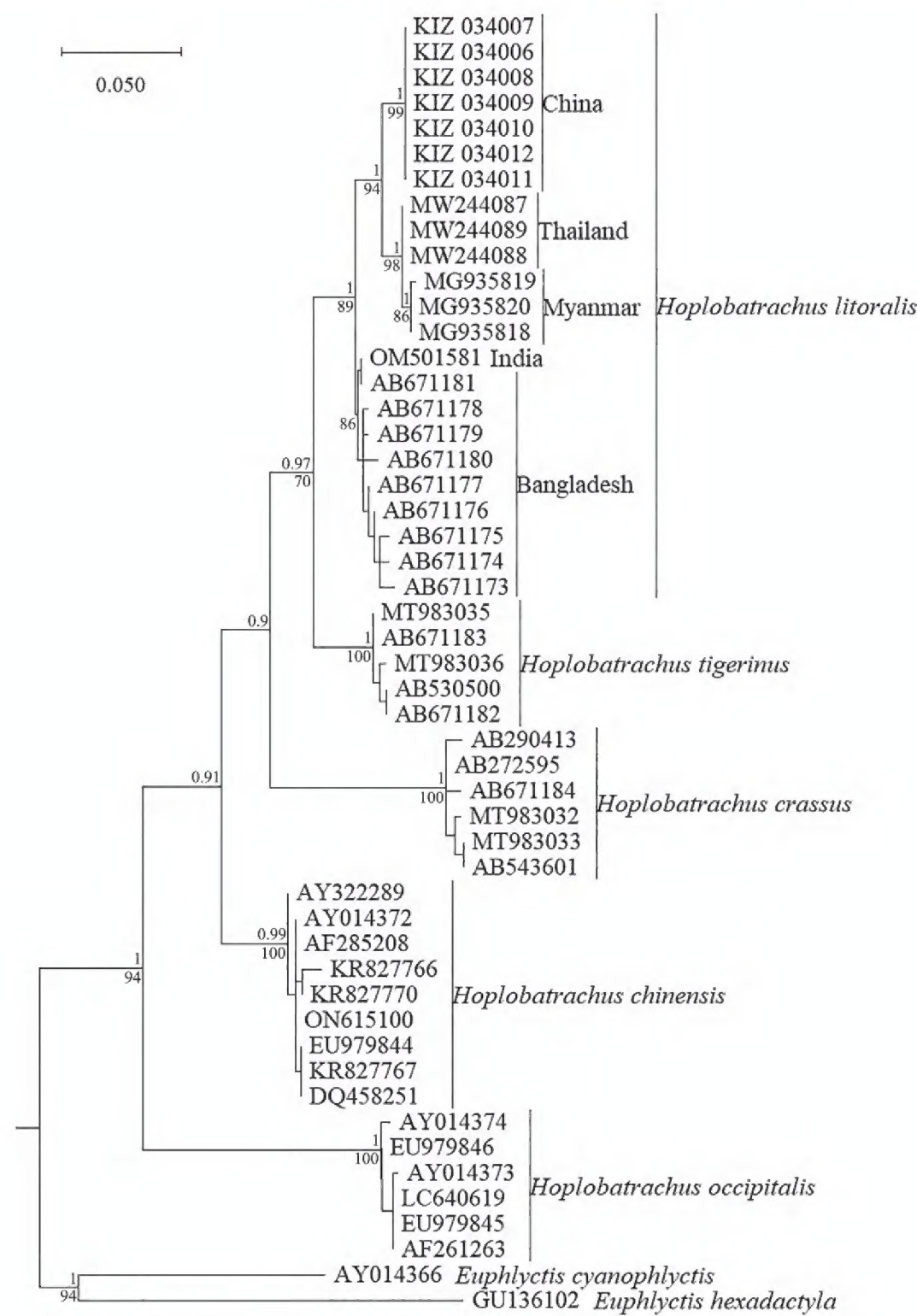


Figure 1. Maximum Likelihood tree based on 16S rRNA sequences. Numbers above branches indicate Bayesian posterior probabilities (values below 0.9 are not shown) and numbers below branches indicate bootstrap support for Maximum Likelihood analysis (values below 70 are not shown).

Table 2. Genetic uncorrected p-distances (%) based on partial 16S rRNA sequences.

	1	2	3	4	5	6	7	8	9	10
1 <i>Hoplobatrachus litoralis</i> (China)										
2 <i>Hoplobatrachus litoralis</i> (Thailand)	1.3									
3 <i>Hoplobatrachus litoralis</i> (Myanmar)	1.6	0.4								
4 <i>Hoplobatrachus litoralis</i> (India)	1.4	1.4	1.8							
5 <i>Hoplobatrachus litoralis</i> (Bangladesh)	1.7	2.2	2.5	0.6						
6 <i>Hoplobatrachus chinensis</i>	4.9	4.2	4.5	3.7	4.2					
7 <i>Hoplobatrachus crassus</i>	6.5	6.4	6.0	5.6	5.9	6.3				
8 <i>Hoplobatrachus occipitalis</i>	11.4	10.5	11.0	10.9	11.2	9.7	11.6			
9 <i>Hoplobatrachus tigerinus</i>	4.3	4.0	4.2	2.8	3.3	4.6	5.4	10.7		
10 <i>Euphlyctis cyanophlyctis</i>	12.6	11.9	12.0	11.7	12.5	12.9	11.7	13.4	12.0	
11 <i>Euphlyctis hexadactyla</i>	13.6	12.6	12.7	11.9	12.8	13.5	13.9	15.2	11.9	12.8

or indistinct in *H. chinensis*, ventral side of head with no spot except for some spots along the edge of lower jaw in *H. litoralis* vs. ventral side of head scattered with black spots in some individuals of *H. chinensis* and dorsal skin relatively smoother in *H. litoralis* vs. dorsal skin relatively rougher in *H. chinensis* (see Fig. 4).

Discussion

This study is the first record of *Hoplobatrachus litoralis* from China. The new locality in China is approximately 770 km away from the type locality of this species and is also the easternmost part of its distribution range to date (Fig. 5). Our work brings the species number of the genus *Hoplobatrachus* in China to two. Species of the genus *Hoplobatrachus* have been regarded as legally protected in China. Finding out how many species of this genus live in China contributes to the better protection of these endangered amphibians.

The specific name of this species is derived from the Latin *litoralis* meaning coastal, as this species was origi-

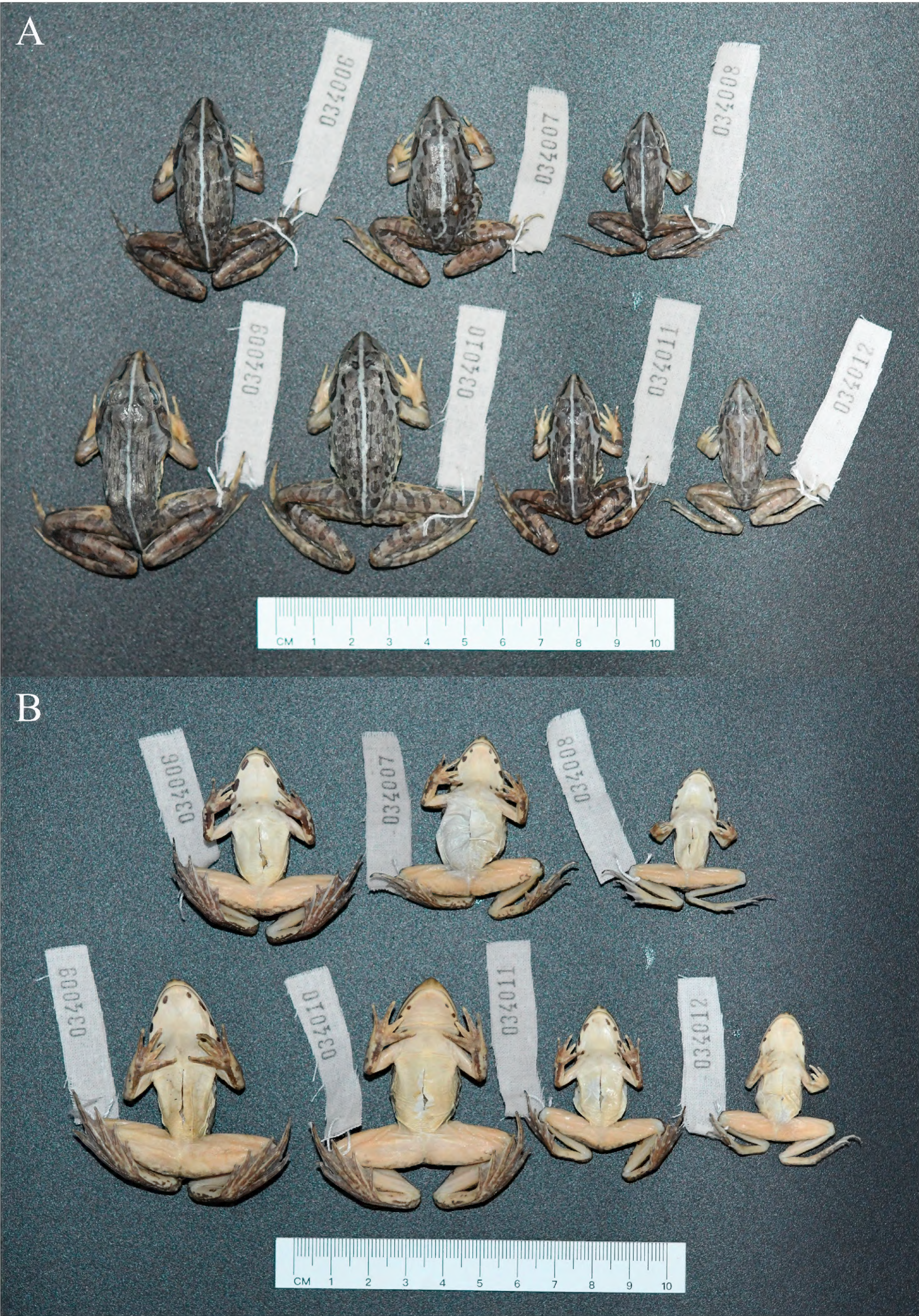


Figure 2. The specimens of *Hoplobatrachus litoralis* from China in preservative. **A.** Dorsal view; **B.** Ventral view.

Table 3. Measurements (in mm) of the specimens of *Hoplobatrachus litoralis* from China. For abbreviations, see Materials and methods.

	KIZ 034006	KIZ 034007	KIZ 034008	KIZ 034009	KIZ 034010	KIZ 034011	KIZ 034012
SVL	48.0	44.1	35.3	55.3	53.3	39.3	34.8
HL	20.3	17.5	15.2	22.4	20.9	16.2	14.3
HW	16.5	14.8	13.0	19.8	18.7	13.5	12.5
S-N	4.5	3.7	3.1	5.1	4.8	3.7	2.8
N-N	3.2	2.7	2.4	4.0	3.8	3.0	2.5
N-E	5.1	4.5	3.4	5.8	5.2	3.8	3.6
ED	6.0	5.3	4.7	6.5	6.4	4.9	4.6
E-E	2.3	2.1	1.8	2.7	2.4	1.5	1.7
ELW	3.3	3.2	2.7	4.0	3.9	3.1	2.7
TD	3.5	3.0	2.4	3.7	3.8	2.8	2.6
FLL	24.2	21.0	17.4	27.5	27.3	19.9	17.9
FHL	18.7	16.5	13.4	22.0	21.3	15.2	13.5
FAW	4.2	3.4	2.6	4.7	4.4	2.6	2.4
HAL	9.8	9.6	7.3	12.7	12.0	8.2	7.4
F1	5.1	5.0	3.8	6.5	6.1	3.7	3.9
F2	4.0	3.7	2.7	4.7	4.1	3.2	2.8
F3	5.8	5.5	4.0	7.6	6.6	5.0	4.6
F4	4.1	3.4	2.6	5.1	4.3	3.4	3.2
HLL	82.1	67.5	55.5	90.9	88.6	62.6	54.6
FEL	23.6	20.0	16.7	26.9	25.8	18.9	15.5
TIL	25.7	20.8	16.9	28.9	27.4	18.8	16.9
TFL	37.8	30.9	25.6	42.3	40.6	28.2	24.9
FOL	25.8	21.7	16.7	28.7	27.0	19.6	16.4
T1	5.9	5.3	4.2	7.2	5.8	4.4	4.2
T2	9.1	7.9	6.6	10.6	9.2	7.8	6.8
T3	13.6	12.1	10.0	16.4	15.1	12.0	9.5
T4	20.3	17.5	15.0	22.8	22.2	17.2	14.0
T5	13.9	11.0	9.2	15.5	14.3	11.1	8.3
IMT	2.6	2.1	2.1	2.9	3.0	1.9	1.7

nally considered to be distributed only in the coastal belt of Bangladesh (Hasan et al. 2012). However, *Hoplobatrachus litoralis* was subsequently found frequently in inland areas far from the coastal belt (Mulcahy et al. 2018; Purkayastha and Besak 2018; Bohra et al. 2019; Kundu et al. 2020; Wangyal et al. 2020; Lalremsanga et al. 2022). This shows that this species is also widespread beyond coastal areas. Therefore, we did not directly translate the specific name plus the generic name as the Chinese name, but chose the translation of Bangladesh plus the generic name as the Chinese name of this species.

Recently, Thongproh et al. (2022) described the specimens from north-western Thailand as a new species of *Hoplobatrachus*, namely *Hoplobatrachus salween* Thongproh, Chunskul, Sringurngam, Waiprom, Makchai, Cota, Duengkae, Duangjai, Hasan, Chuaynkern & Chuaynkern, 2022 and they considered the previous record of *H. litoralis* from northern Tanintharyi, Myanmar, also to belong to *H. salween* (Thongproh et al. 2022). However, through our phylogenetic analysis based on 16S rRNA, the specimens from China, the specimens of *H. salween* from Thailand and Myanmar and the specimens of *H. litoralis* from Bangladesh and India formed a monophyletic clade (Fig. 1). Although the average genetic distance between the specimens of *H. salween* and the specimens of *H. litoralis* from Bangladesh reached 2.2%–2.5% in this study, the genetic distance between the specimens of *H. salween*

Table 4. Comparison of body ratios between the specimens of *Hoplobatrachus litoralis* from its type locality and from China. Data for the specimens from its type locality were obtained from Hasan et al. (2012).

	<i>Hoplobatrachus litoralis</i> (Bangladesh, n = 27)		<i>Hoplobatrachus litoralis</i> (China, n = 7)	
	Mean	Min–Max	Mean	Min–Max
HL/SVL	0.378	0.349–0.436	0.410	0.392–0.431
HW/SVL	0.359	0.316–0.400	0.351	0.336–0.368
S-N/SVL	0.062	0.044–0.076	0.089	0.080–0.094
N-N/SVL	0.063	0.051–0.073	0.070	0.061–0.076
N-E/SVL	0.090	0.065–0.108	0.101	0.096–0.106
ED/SVL	0.082	0.063–0.107	0.125	0.118–0.133
E-E/SVL	0.041	0.029–0.054	0.047	0.038–0.051
ELW/SVL	0.075	0.060–0.094	0.074	0.069–0.079
TD/SVL	0.069	0.051–0.083	0.070	0.067–0.075
FLL/SVL	0.541	0.484–0.626	0.500	0.476–0.514
FHL/SVL	0.384	0.331–0.418	0.388	0.374–0.400
FAW/SVL	0.086	0.059–0.121	0.077	0.066–0.088
HAL/SVL	0.193	0.175–0.206	0.215	0.204–0.230
F1/SVL	0.104	0.081–0.131	0.109	0.094–0.118
F2/SVL	0.077	0.060–0.112	0.081	0.076–0.085
F3/SVL	0.111	0.091–0.132	0.126	0.113–0.137
F4/SVL	0.074	0.053–0.093	0.084	0.074–0.092
HLL/SVL	1.586	1.400–1.703	1.612	1.531–1.710
FEL/SVL	0.498	0.438–0.569	0.474	0.445–0.492
TIL/SVL	0.504	0.469–0.531	0.498	0.472–0.535
TFL/SVL	0.726	0.625–0.782	0.739	0.701–0.788
FOL/SVL	0.479	0.436–0.539	0.500	0.471–0.538
T1/SVL	0.100	0.075–0.117	0.119	0.109–0.130
T2/SVL	0.179	0.149–0.218	0.188	0.173–0.198
T3/SVL	0.244	0.193–0.280	0.286	0.273–0.305
T4/SVL	0.323	0.277–0.368	0.416	0.397–0.438
T5/SVL	0.228	0.177–0.280	0.267	0.239–0.290
IMT/SVL	0.053	0.043–0.069	0.052	0.048–0.059
HL/HW	0.055	0.961–1.222	1.168	1.118–1.230
S-N/N-E	0.693	0.479–0.909	0.881	0.778–0.974
ED/E-E	2.054	1.333–2.808	2.684	2.407–3.267
TD/ED	0.846	0.600–1.152	0.566	0.511–0.594
N-N/E-E	1.575	1.150–2.192	1.507	1.286–2.000
ELW/E-E	1.875	1.234–2.909	1.603	1.435–2.067
F1/F2	1.375	1.011–1.632	1.351	1.156–1.488
TIL/FEL	1.015	0.871–1.137	1.052	0.995–1.090
FOL/FEL	0.966	0.966–1.169	1.055	1.000–1.093
TIL/FOL	1.054	0.973–1.148	0.997	0.959–1.030

and the specimen of *H. litoralis* from India is only 1.4%–1.8% (Table 2). In addition, the average genetic distance between the specimens of *H. salween* and the specimens from China is only 1.3%–1.6% (Table 2). Therefore, the molecular data do not support *H. salween* and *H. litoralis* being two separate species. Morphologically, according to Thongproh et al. (2022), the snout to anterior eye stripe is indistinct in *H. salween*, whereas distinct in *H. litoralis*, the supralabial stripe is indistinct in *H. salween*, whereas distinct in *H. litoralis*, the dark supratympanic stripe is present in *H. salween*, whereas absent in *H. litoralis*, the hand pattern is mottled in *H. salween*, whereas uniform in *H. litoralis*, the web pattern is mottled with an irregular pattern in *H. salween*, whereas uniform grey in *H. litoralis*, the tubercles on the dorsal tibia of males are densely in *H. salween*, whereas few in *H. litoralis*, sexual dichromatism is present in *H. salween*, whereas absent in *H. litoralis* during the breeding season, the relative finger

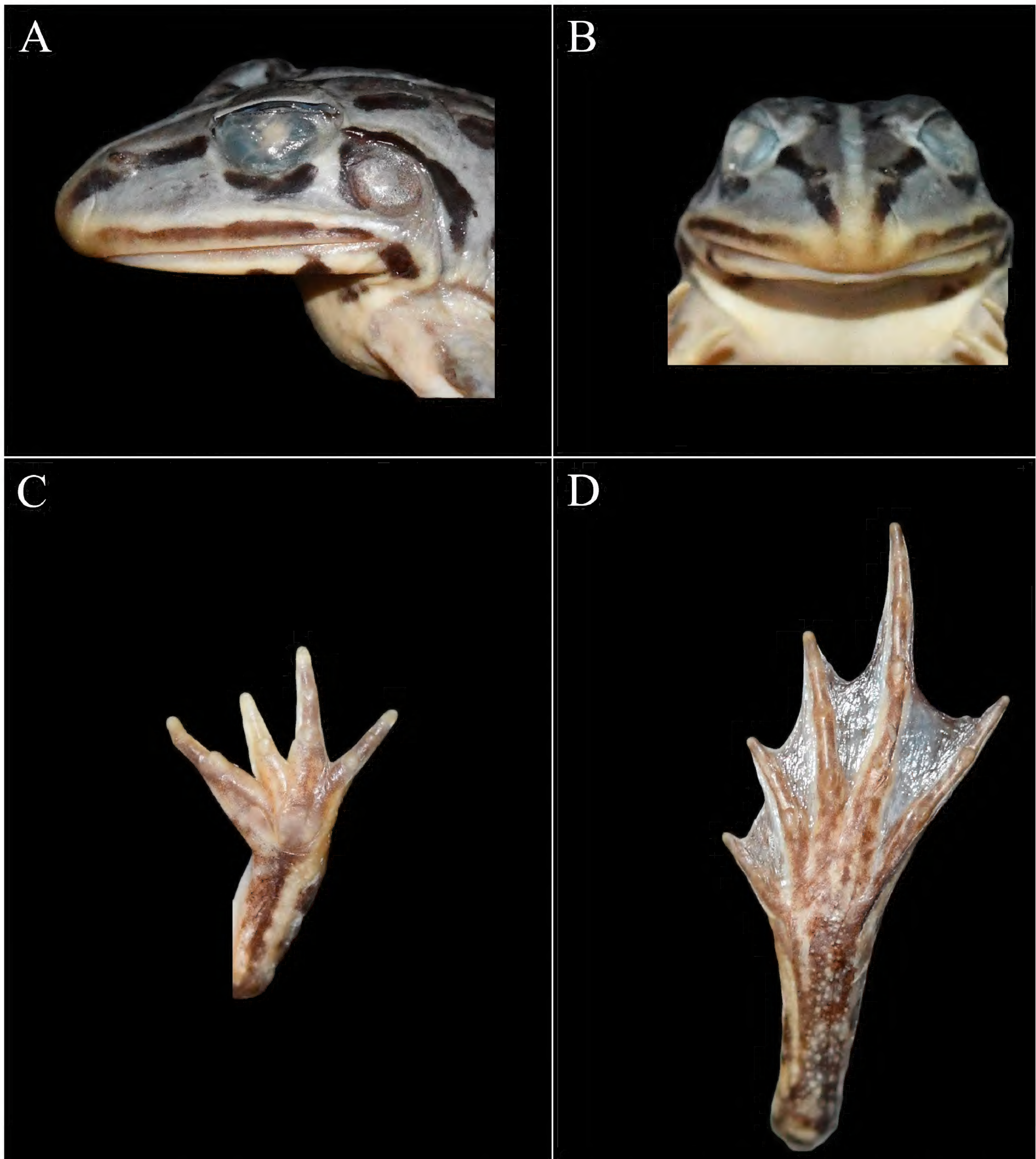


Figure 3. Close-up views of the specimen (KIZ 034010) of *Hoplobatrachus litoralis* from China in preservative. **A.** Lateral view of the head; **B.** Front view of the head; **C.** Volar view of left hand; **D.** Plantar view of left foot.

length is $F3 > F1 > F4 > F2$ in *H. salween*, whereas $F3 > F1 > F2 > F4$ in *H. litoralis* and the relative toe length is $T4 > T3 > T5 > T2 > T1$ in *H. salween*, whereas $T4 > T5 > T3 > T2 > T1$ in *H. litoralis*. However, the snout to anterior eye stripe is distinct in some individuals of *H. salween* (see fig. 6A in Thongproh et al. (2022)), the supralabial stripe is distinct in some individuals of *H. salween* (see fig. 6B in Thongproh et al. (2022)), the dark supratympanic stripe is present in some individuals of *H. litoralis* (see fig. 1A in Hasan et al. (2012) and fig. 2 in Lalremsanga et al. (2022))

and, in the specimens from China, the hand pattern is not uniform in the specimens from China, the relative finger length is either $F3 > F1 > F2 > F4$ or $F3 > F1 > F4 > F2$ in the specimens from China and the relative toe length is either $T4 > T5 > T3 > T2 > T1$ or $T4 > T3 > T5 > T2 > T1$ in the specimens from China. In addition, we found that the adult males from western Yunnan in life also present almost completely yellow colouration during the breeding season. We are not sure whether the remaining two differences in the web colouration and the tubercles



Figure 4. Comparison of *Hoplobatrachus litoralis* and *H. chinensis*. **A, B.** *H. litoralis* in life from western Yunnan, China; **C, D.** *H. chinensis* in life from southern Yunnan, China.

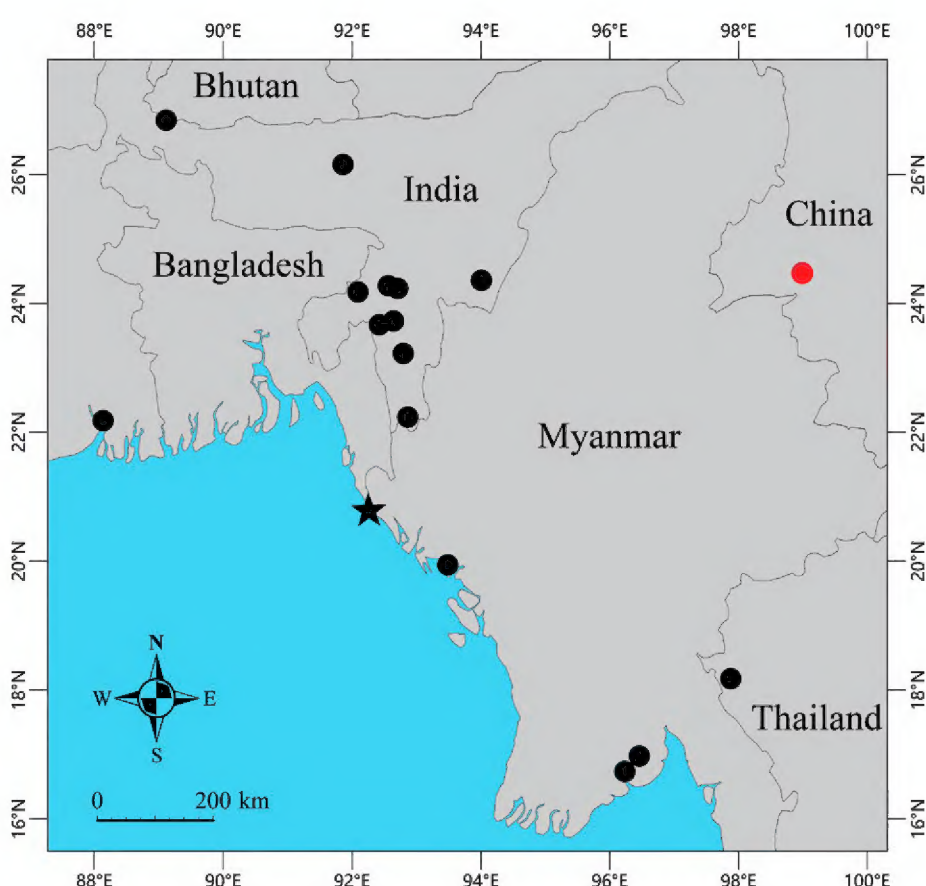


Figure 5. Map showing the currently known distribution of *Hoplobatrachus litoralis*. The black star indicates the type locality, black dots indicate previously published records and the red dot indicates the new record in China.

on the dorsal tibia are stable and these differences seem to be insufficient to distinguish different species, they may be treated as intraspecific variation. To sum up, *H. litoralis* and *H. salween* cannot be completely separated in both morphological and molecular markers and the specimens from China seem to represent the transitional type between *H. litoralis* and *H. salween*. Therefore, we consider that *H. salween* should be a junior synonym of *H. litoralis*.

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